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Concealment, Vest

CONFIDENTIAL

Proposal

on

FOAM VESTS BY ARMOUR RESEARCH

to

Morgan Manufacturing Company

Part I - Technical

25X1

Submitted by

Chemistry and Chemical Engineering Research Department

25X1

Copy No. 1

July 10, 1957

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FOAM VESTS

I. INTRODUCTION

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This process still is in need of improvement, specifically with respect to adequate strength of the foamed material in the thin sections along the edges, with respect to means of fastening the vest to the body, in such a manner that it may be removed very quickly, in case the need for discarding it develops, and with respect to giving a minimum of discomfort to the wearer.

This proposal suggests means and ways of overcoming these shortcomings.

II. PROPOSED RESEARCH

A. Type of Foam

Up to now, the work has been concentrated on the production of a vest based on a polyurethane foam. Polyurethane foams generally have good tensile and tear strength, and chemical and rot resistance, but their light resistance is poor.

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Production of a polyurethane foam comprises essentially the reacting of a polyether or a polyester with a diisocyanate, in the presence of a controlled amount of water. The result is chain extension of the polyether or polyester and evolution of carbon dioxide. The reaction is very fast, so the viscosity of the reaction mixture increases rapidly and the carbon dioxide is trapped in bubble form. It takes only a few minutes for the foamed material to become solid. The density of the foam will vary greatly with the water content of the mixture.

It is readily seen from this brief description that the uniform production of polyurethane foams require exacting processing controls. However, prepolymers have become available recently which makes it easier to control the actual foaming step.

The polyurethane foams are resistant to slight pressures, but compress deeply and suddenly to the "bottoming" point at higher pressures, and the recovery is relatively slow. Such foams have a different feel, therefore, from that of rubber or vinyl foams. While rubber foams probably should not be considered because of their low tensile strength and poor light and chemical resistance, it appears to be strongly indicated that vinyl foams should be given serious consideration. Vinyl foams have good tensile strength, and chemical and rot resistance. In addition, controlled formulating and processing is easy.

B. Production of the Foamed Vest

The production method for the vest will vary with the type of foam selected. For a study of polyurethane foams, the reacting mixture will be cast in a mold and the foam allowed to develop at room temperature. An after cure at moderately elevated temperature will probably be desirable.

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Vinyl foams are produced either by a mechanical or a chemical method. The latter is probably the method which will be employed here. In the chemical method a chemical blowing agent is incorporated in a plastisol, the temperature is raised to the point where the blowing agent decomposes to release the gas necessary for the foaming and subsequently the temperature is raised to the point necessary for the fusion of the plastisol. This method lends itself to variations and the foaming step may be performed in a mold, or in some cases on a belt for the production of continuous sheeting of foamed material.

Up to now, the production of the foamed vest has been considered to consist of the foaming of a plastic directly in a mold for the vest. While this approach certainly will be pursued further, other methods should be considered also. Thus, it is planned to prepare a foamed sheet of uniform thickness and to subject such a sheet to a post-forming step which may be either a vacuum bag-like step or perhaps a deep drawing step. The advantage of such a procedure would be that the cells or pores would be formed in a plastic layer of uniform thickness. Therefore, one would avoid the great difference in pore sizes between the edges and the center of the vest which is so apparent, in the vest produced thus far.

The development of a practical method for the production of individually fitted vests will be a part of this fabrication study.

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C. Human Engineering Studies

The aid of the Human Engineering group of the Mechanics Department will be enlisted, on an unclassified basis, for a study of the best design for the "harness" to hold the vest to the body, both from the point of view of comfort and of speedy disposal. This group will also consider other comfort aspects of the problem, such as ways and means of alleviating perspiration, and so on.

III. PERSONNEL AND BACKGROUND

This program will be placed in the Chemical Engineering and Polymer Research section, the personnel of which have extensive background both in the plastics and the foaming techniques involved.

IV. TIME AND MANPOWER SCHEDULE

In view of the urgency, the program will be divided into two phases. In the first phase, which is expected to cover 4 months and a manpower input of 2-1/2 man-month, the effort will be concentrated on the development of a usable vest, with fixed dimensions. In the second phase, which is expected to cover 6 months and a manpower input of 1-1/2 man-month, the developments of the first phase will be refined and improved, and techniques for the production of individualized vests will be developed.

V. CONCLUSION

The Foundation recognizes the importance and urgency of this program. Since the program is one well suited to the staff's capabilities,

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the Foundation looks forward to the opportunity to conduct this investigation.

Respectfully submitted,

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Scientific Advisor

Approved by:

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Chemistry and Chemical Engineering
Research Department

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Part II - Cost Estimate

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FOAM VESTS

COST ESTIMATE

The estimated cost of the 10 months' program is as follows:

Scientific personnel - 19 man-months at an average rate of $850/man-month	$16,150
Shop Labor - 100 man-hours at an average rate of $2.80/hr	280
Total salaries and wages	$16,430
Overhead at actual cost, estimated at 86% of salaries and wages	14,130
Fabricating equipment	3,000
Expendable materials and supplies	1,000
Reproduction of reports	100
Travel, telephone and conferences	500
Fixed fee	2,110
Total	$37,270

It is to be understood that the itemized figures of cost are not to be construed as limits on any particular expenditure. However, the total figure is a limiting value beyond which expenditures will not be made without further contractual arrangements.

Respectfully submitted,

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Scientific Advisor

Approved by:

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Chemistry and Chemical Engineering
Research Department

ARMOUR RESEARCH FOUNDATION OF ILLINOIS INSTITUTE OF TECHNOLOGY

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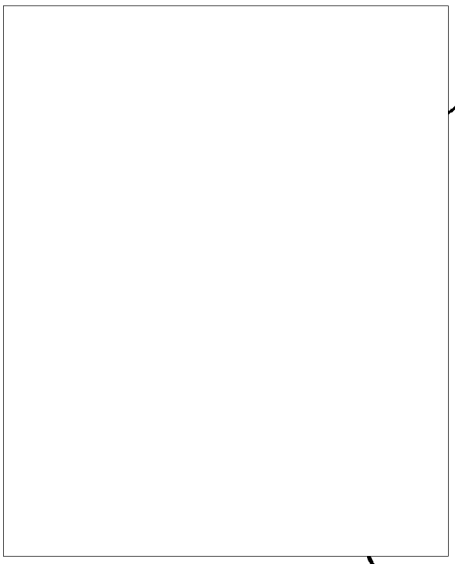

Proposal

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Part II - Cost Estimate
(Revised)

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Proposal

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FOAM VESTS

to

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Part II - Cost Estimate
(Revised)

Submitted by

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August 8, 1957

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FOAM VESTS

COST ESTIMATE

Phase I

This phase is expected to require 4 months with an estimated cost as follows:

Scientific personnel - 10 man-months at an average rate of $850/man-month	$8,500
Shop labor - 50 man-hours at an average rate of $2.80/hr	140
Total Salaries and Wages	$8,640
Overhead at actual cost, estimated at 86% of salaries and wages	7,430
Fabricating equipment	2,000
Expendable materials and supplies	500
Reproduction of reports	40
Travel, telephone and conferences	200
Fixed fee	1,129
TOTAL	$19,939

Phase II

This phase is expected to require 6 months with an estimated cost as follows:

Scientific personnel - 9 man-months at an average rate of $850/man-month	$7,650
Shop labor - 50 man-hours at an average rate of $2.80/hr	140
Total Salaries and Wages	$7,790
Overhead at actual cost, estimated at 86% of salaries and wages	6,699
Fabricating equipment	1,000
Expendable materials and supplies	500
Reproduction of reports	60
Travel, telephone and conferences	300
Fixed fee	981
TOTAL	$17,330

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